Nutrition News

OCTOBER, 1959 • • VOLUME 22 • • NUMBER 3

NUTRITION FOR THE ASTRONAUT

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Man's first rocket rides will be short, perhaps so short that food will not be needed. Later, he will ride for longer periods, perhaps for two or three days. For these trips he will need food and water. Still later, he may voyage for six to nine months. And eventually, man may travel in space for periods of years or even generations.

During the past decade the Departments of the Air Force and the Navy, at their respective research centers, have anticipated and studied many of the medical problems to be encountered in space travel. This work pertains to: (1) the effects of the gravitational forces on man as he launches into space and reenters the earth's atmosphere; (2) the effects of solar and cosmic radiation; (3) the physiological requirements of man in a sealed cabin—consideration has been given to oxygen requirements, carbon dioxide levels, temperature control, safe cabin pressures, removal of noxious gases, and noise control; (4) the effects of weightlessness on the perceptual processes; and (5) the effects on behavior produced by environmental conditions of space travel.

Let us review the operational conditions which will exist during initial flights of sufficient duration to require food. The astronaut will travel alone in a sealed cabin. For purposes of protection in the event of emergency he will wear a full pressure suit assembly, including helmet and gloves. Forces involved in take-off, transformation to a state of weightlessness, heat, vibration, noise, exploration of the unknown, and a desire to return to earth with as much data as possible will subject our traveler to tremendous stresses. These will be both psychological and physical.

For these short trips the astronaut will carry stored oxygen, water, and food. Restricted body movement and limitations in weight, space, and power will prohibit food preparation.

Weightlessness, in conjunction with many necessary protective measures, will make the handling and eating of food somewhat difficult. Liquids and semisolid foods will be served from collapsible "squeeze" tubes, in lieu of the usual utensils. A pontube, fitted to the end of each tube, will be placed directly into the mouth and food will be transmitted by applying pressure to the tube. Solids in bitesize form will be removed manually from a covered container and placed into the mouth.

Data now available to us indicates the feasibility of using a high-protein liquid diet for initial space flights, should a diet of this consistency be required. A liquid diet, high in protein, adequate but minimum in calories for an individual engaged in sedentary activity, and adequate with respect to the other nutrients, was formulated. After it was evaluated for consumer acceptability, its physiological and possible psychological effects when consumed exclusively for a five-day test period were tested.

Fifteen military and civilian men ranging in age from 21 to 29 years were recruited on a voluntary basis. Each day's meals provided approximately 2500 calories and 100 grams of protein. The latter was obtained by the use of two protein supplements. One was combined with coffee and the other with a vegetable puree. Protein was also obtained from strained meats and a concentrated ice cream mix.

All subjects rated their physical condition as excellent or good at the beginning of the test and at the end. Since weight changes were insignificant and the caloric intake adequate for the activity performed, the feeling of hunger which was reported may be attributed to the small bulk of the diet.

What will the astronaut eat? The answer to this question is much more difficult because of the role that food plays in a situation of stress. This is evidenced by data obtained from isolation studies conducted at the Aero Medical Laboratory, Wright Air Development Center.

Colonel Stapp, USAF

Palatability and acceptability of foods in many instances were contrary to that on the ground or in the air. Some foods usually rated low in acceptability have a moderate-to-high degree of acceptability in isolation. The ability to discriminate one food from another in the same food group is also impaired. All meats taste alike. Subjects are unable to distinguish one canned fruit from another. White, whole wheat, and rye breads are frequently considered similar in taste. Apparently the removal of the visual cues usually associated with eating interferes with the taste and enjoyment of food and therefore the acceptability of food.

When will the astronaut eat? Consumption of food at 2 to 3 hour intervals is considered necessary to help insure an optimum state of nutrition at all times. It is most likely that the stress inherent in space flight will markedly interfere with appetite. Changes in day-night cycling while orbiting as well as adaptation to a state of weightlessness may diminish the desire for food. Permitting the astronaut to regulate intake according to personal desire for food and fluid may mean that when

(Continued on Page Twelve)

PUBLISHED BY NATIONAL DAIRY COUNCIL - CHICAGO

Published January — February — April — October — December
NATIONAL DAIRY COUNCIL, CHICAGO 6

Glances AT NUTRITION RESEARCH

The earth is man's space ship supplying him with all of the substances necessary for life. Space travel will require that man design a miniature closed ecological system duplicating earth's functions.

Functions of food in space flight — Flight duration determines the nature of the nutritional problem in space flight. Short flights do not make a balanced diet necessary while long flights present problems of water recycling and use of dehydrated foods. As the result of a 32-hour manned balloon flight, the feeding pattern suggests that eating serves three separate functions. At the beginning of the flight, the traveller is too busy with observations to eat beyond requirements of sustenance. Easy to eat, high energy foods are favored. On long flights, mealtime becomes a ceremony and breaks monotony. Food also serves as a cushion against stress and candy is nibbled during periods of operational tension.

—*"Nutrition in Space Flight," David G. Simons. Food Technology, Vol. 12:436 (Sept.) 1958.*

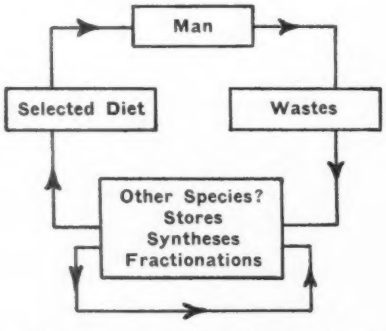
Attitude and taste — When it becomes uneconomical to transport food, plans must be made for regeneration of carbon and nitrogen compounds. Then food will no longer limit the duration of space flight. Surprising results are noted when special foods are tested under operational conditions. Bite-size salami sandwiches are unpopular, but bite-size chip beef sandwiches are well-liked. Foods in tablet form are poorly received, but certain particular food items are well-liked such as chocolate butter cream tablets and cheese tablets.

—*"Feeding Crews in Air Vehicles of the Future," Beatrice Finkelstein. Food Technology, Vol. 12:429 (Sept.) 1958.*

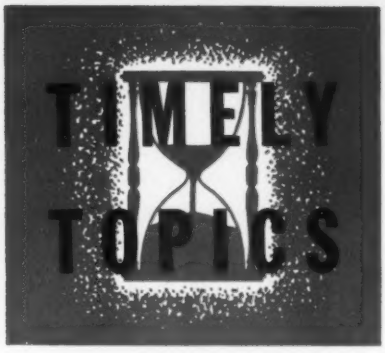
Microcosm "run down"—In every closed cycle system there appears a "run down" or limiting factor. In the ecological system we know on earth, the "run down" factor is the availability of solar energy. Factors which limit the closed biological system for space travellers are: disposal or storage of waste, consumption of such non-cyclic factors as vitamins, and generation of toxic materials.

—*"Closed Cycle Biological Systems for Space Feeding," M. C. Brockmann, A. S. Henick, G. W. Kurtz, and R. G. Tischer. Food Technology, Vol. 12:429 (Sept.) 1958.*

Food Cycle for Space Flight — A diet composed of synthetic or highly purified nutrients has been proposed for extended space flights. Studies are outlined to demonstrate the adequacy of the diet, to develop the equipment for synthesis, fractionations, and analyses. The development of an efficient closed food cycle is the most important project to be completed before extended space travel can be undertaken.



—*"A Closed Food Cycle Atomic Conservation for Space Flight," C. C. Clark. J. Aviation Med., Vol. 29:535 (July) 1958.*



Colonel Stapp, USAF

Colonel John Paul Stapp, was named Chief of the Aero Medical Laboratory, Wright Air Development Center, at Wright-Patterson Air Force Base, Ohio, in April of 1958.

Called the "fastest man on earth," Colonel Stapp rode a rocket-propelled sled at 632 miles per hour (1954) in one of a series of human sled runs to determine the effects on pilots bailing out at very high altitudes and at supersonic speeds.

Among his research achievements, Col. Stapp has conducted very high altitude unpressurized flight tests of a liquid oxygen breathing system; studies on the effect of windblast, (including a flight in an F-89 with the canopy removed); and human deceleration studies including 76 human experiments on rocket-powered sleds.

Colonel Stapp was a volunteer for 29 of these tests. He sustained two arm fractures, a rib fracture, retinal hemorrhage, and moderate degrees of concussion in the course of these experiments, but succeeded in exploring human tolerance to crash type forces, establishing human limits considerably in excess of aircraft strength specifications.

Among the many honors received by Col. Stapp for his pioneering work in Aviation and Space Medicine are: the Gorgas award, Association of Military Surgeons (1957); the Liljencrantz Award, Aeromedical Association (1957); and the Service Award, Distinguished Graduate, University of Minnesota Medical School (1958).

Colonel Stapp has the following affiliations with professional organizations: President, American Rocket Society; Vice President, Aero Medical Association, of which he is a Fellow Member, Society of Automotive Engineers and member of Seat Belt Committee; Member, American Association of Military Surgeons; and Member, National Research Council, Bioastronautics Committee.

HOME-DELIVERED MEALS

By Charlotte E. Smith, Nutrition Consultant, Ohio Department of Health and Member, Advisory Board, Meals on Wheels, Inc. of Columbus, Ohio

Since the majority of our aged and handicapped citizens live independently or with family or friends, a community service which contributes toward making home living more satisfactory is well received. One such community service is Meals on Wheels—a program which provides home-delivered meals to individuals who because of age or disability are unable to secure or prepare adequate meals.

In Columbus, Ohio, Meals on Wheels, Inc., is a non-profit organization which has been in operation since April, 1957. The service delivers seven days each week, a unit which includes a hot dinner meal and milk, a lunch of sandwich and fresh fruit and a breakfast or midmorning snack of fruit juice, milk, and an individual package of prepared cereal or a sweet roll.

Food is prepared by an established restaurant, and packaged according to specifications so that the dinner meal is hot on delivery. Rotation menus prepared by dietitians of the Columbus Dietetic Association are used. On week days, delivery is made by a fleet of taxicabs. On Sundays, volunteers deliver the meals, taking time for a friendly visit at each stop.

A sliding scale based on need is used to determine the amount of payment to be made. A small percentage of recipients pay the full amount of $2.00 per day. However, the majority pay a portion of this amount, usually 80 cents. Funds to make up the deficit are obtained by contributions from interested community groups and individuals; fund-raising activities such as dinners and bridge parties; and activities of small, organized auxiliary groups known as "Wheels."

Improvements in physical health and morale of clients receiving the meals over a period of time have been enthusiastically noted by case workers, public health nurses, neighbors and friends. Some of the clients after regaining strength and incentive have gone back, at least temporarily, to preparing their own meals.

Philadelphia organized a Meals on Wheels program in 1954. It differs from the Columbus program in that the food is prepared in the Lighthouse, a "Red Feather" settlement house. Financing has been by contributions, grants from foundations and from regular Lighthouse funds, as well as from fees paid by clients, usually 40 to 80 cents.

In 1958, Rochester, New York, began a food service for elderly people in their own homes on a three-year pilot project basis. Among other cities where programs are in operation are East Orange, New Jersey; Dallas, Texas; and Mansfield, Ohio.

Services such as Meals on Wheels can assist many of our aged and handicapped citizens living in their own residences to enjoy a better life.

FOOD EXPERIENCES IN AN ELEMENTARY SCHOOL

By Ruth H. Stone, Supervisor of Home Economics Endicott Public Schools, Endicott, N. Y.

We are in the process of creating what we hope will grow into a satisfying story of a complete elementary school program in home economics.

In Endicott in 1950 we had 7 elementary schools with about 90 classroom teachers. Our school system was committed to an in-service training program which excluded any extensive study of, or plan for, home economics. We had practically no equipment and frankly we had no real desire for any more additions to what teachers felt was a crowded day.

After several conferences with Miss Anne McGuinness, the Elementary Supervisor of Endicott Schools, we decided to experiment at one grade level. In our community many mothers work, and while homes are well-equipped and there is money for good and ample food, many children are not well-nourished. We chose to begin with a food experience which could be brought into the weekly program as another means of helping the child learn. A cooking experience is always a good start, it seems to me, because it is charged with discovery and emotion.

We invited all third grade teachers to meet. The meeting was conducted much as the teachers might meet with their pupils. A breakfast demonstration was given with a discussion on ways such an activity might correlate with various subjects.

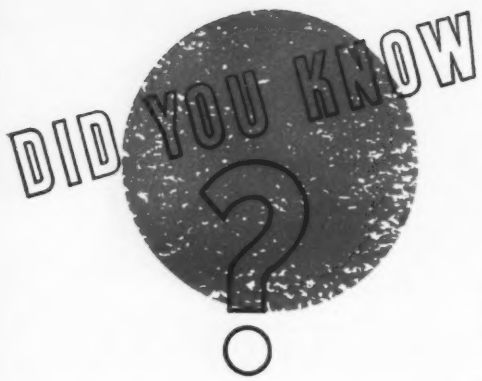
Before long, one third grade teacher after another tried a realistic food experience in her room. Each school had been provided with a hot plate. Other pieces of equipment were borrowed from P.T.A. kitchens or brought from home by pupils.

We are not attempting to inflict adult standards or responsibilities upon children, but to help them grow with improved attitudes toward food and home tasks. I am not concerned with a third grader knowing the food elements of the breakfast he helps to cook, serve, and eat, but with his opportunity for doing it.

Some of these third graders are now sixth graders, and are doing a simple classroom experiment with yeast, to show the need of growing things for food. They compare the growth of yeast in three different food mediums: With starch and sugar; with starch, sugar and gelatin (an incomplete protein); and with starch, sugar and with a complete protein. They use whole milk for their experiment.

This test requires the simplest of equipment and materials — available from home. Yet, the impact of watching and comparing how the yeast grows under these three conditions helps a child grasp several scientific concepts. He learns that all plants and animals need food, moisture, warmth, and usually air for life. He learns that the quantity as well as the kind of food plays an important part in growth. From this he can relate that his own meals and snacks should contain the foods needed for growth.

We are trying to give experiences that children can manage right now and building our learnings and concepts around them, rather than beginning with specific objectives. It is intended that the program will continue to develop spiral-like, as most good programs do, with the child building each year upon what he has learned the year before.



—that Tibet has a well-known proverb which says that even the nibbling rabbit can gorge itself to death?

—that Wisconsin scientists report whey, a byproduct of the cheese industry, has a potential use as a fertilizer?

—that many new milking parlors are designed and built with steps instead of ramps since cows find them easier and safer to use when going from one level to another?

—that results from a recent study of over 2000 persons disputes the current labeling of high blood pressure and arteriosclerosis as the occupational disorders of the executive?

—that Navy men drink about a quart of milk a day, on the average, while ashore in the United States; 19 ounces on shipboard and about 25 ounces a day when in other countries?

—that an Ordonnance of the Provost of Paris, in 1396, forbade the coloring of butter with "saucy flowers," herbs, or drugs, and old butter was not to be mixed with new, under penalty?

—that the calcium of ice cream is as well used by the body as is the calcium of milk?

THINGS YOU'LL LIKE TO READ

Nutrition in Pregnancy — Ed., Council on Foods and Nutrition, American Medical Assoc., Chicago 1958.

This monograph contains five papers presented in 1957 at the symposium sponsored by the Council, with the cooperation of the Boone County Medical Society, The University of Missouri School of Medicine, and the Adult Education and Extension Service of the University of Missouri. Dr. Robert T. Jackson, Chairman of the Department of Pediatrics, University of Missouri School of Medicine, in the introduction to the five research reports states, "Much evidence exists that the nutritional management of mothers could be improved greatly if our present knowledge is applied. The improved nutritional status of the mothers would thereby promote the health and vitality of human beings by enhancing the endowment with which they start their lives." Available on request.

Grade A Dry Milk Products—Recommended Sanitation Ordinance and Code, 1959—Supplement I to the Milk Ordinance and Code, 1953.

These are recommended sanitation standards for the manufacture of dry milk products intended for use in the commercial preparation of Grade A pasteurized milk products. Like the parent document, this supplement has the approval and endorsement of the U.S. Dept. of Agriculture, and the Public Health Service, U. S. Dept. of Health, Education, and Welfare, for voluntary adoption by states, counties, and municipalities. Available from U. S. Dept. of Health, Education, and Welfare — Bureau of State Services, Division of Engineering Services, Milk and Food Program.

NUTRITION FOR THE ASTRONAUT

(Continued from Page Nine)

an emergency arises the subject's state of hydration and nutrition may already be inadequate. Manned high-altitude balloon flight experiences suggest a need for the frequent scheduled consumption of food.

Protective clothing to be worn during initial space flights precludes defecation. In order to cope with this problem, a high-protein low-residue diet for 72 hours prior to take-off has been formulated. This diet provides foods which are completely absorbed from the gastro-intestinal tract — leaving little or no bulk for the formation of feces. Preflight feeding recommendations are made for a high-carbohydrate, moderate protein, low-fat meal immediately prior to take-off. A meal of this type is conducive to increased altitude tolerance.

Foods recommended by Beatrice Finkelstein, Nutritionist, Aero Medical laboratory of the Wright Air Development Center, for consumption while in flight, consist of a variety of sandwiches, meat such as beef, turkey, and ham, fruit sauces, fruit juices, chocolate milk drink, cookies, and candy. These foods furnish approximately 2000 calories per day. Three thousand milliliters of water will be provided for each day of flight. Use of a multivitamin preparation during flight is recommended. Experimental data exist which indicate the beneficial effects of water-soluble vitamins during stress.

Formulation of this type of feeding program is based on knowledge of flight feeding requirements, the experience of crews who have flown high-altitude, high-performance aircraft, and those who have made high-altitude balloon flights, as well as controlled laboratory studies. Yet these plans for feeding in space have been designed with a limited knowledge of the stresses produced by confinement in a sealed cockpit rushing through space, and we are in no position to accurately judge man's ability to eat under prolonged conditions of weightlessness.

Conditions of extreme stress and weightlessness cannot be simulated on the ground. Certainty as to the nutritional requirements and feeding needs will come only when man finally enters space and returns in safety to give us the data.